REMARKS

Applicant respectfully requests reconsideration of the present application in view of the reasons that follow. No claims are amended, added, or canceled. Thus, claims 1-9 remain pending and are submitted for reconsideration.

Applicant wishes to thank the Examiner for the careful consideration given to the claims as well as acknowledging Applicant's claim of foreign priority and the receipt of the certified copy of the priority document.

Rejection of Claims 1-2, 4-5, and 7-8 based on Tokoro

Claims 1-2, 4-5, and 7-8 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 4,631,043 ("Tokoro"). This rejection is traversed for at least the reason that Tokoro fails to disclose or teach the present invention.

As background, an existing engine torque in the prior art is estimated and practically used for suitably controlling the line pressure of a transmission in accordance with an input torque from the engine. In such a case, it is necessary to derive the estimated value of the existing engine torque, and there are two methods for estimating the existing engine torque. One method of estimation includes producing a target torque signal based on an engine speed and a target transmission gear ratio that vary in accordance with the operational condition of the associated motor vehicle. The estimated engine torque is then derived based on the value of the target torque signal. The other method of estimation includes producing an actual torque signal by actually measuring an actual engine torque in which the estimated engine torque is derived based on the value of the actual torque signal.

Of these two methods, the latter method (i.e., the method of using the actual torque signal) has been widely employed. In this method, due to its nature, an exact value of the actual torque signal that corresponds to the actual engine torque is obtained. However, because the actual torque signal is achieved based on the engine control that is based on the target torque signal, the input of the actual torque signal to a control system tends to be delayed as compared with that of the target torque signal. Accordingly, the time lag from the input of the actual torque signal to the actual control for the line pressure and to the actual shifting of the pulleys has not been sufficiently compensated.

The present invention has been provided to address the above-mentioned drawback. In the present invention, a unique measure is employed for deriving the estimated engine torque by noting that the input of the target torque signal can be obtained earlier than that of

the actual torque signal and by noting that the actual torque signal has a higher accuracy as compared with the target torque signal. Thus, in the present invention, the target torque signal and the actual torque signal are combined to constitute a valuable information signal that is used for deriving the estimated engine torque. Therefore, in the present invention, both the advantage of the target torque signal and the advantage of the actual torque signal are used in a practical sense for deriving an estimated engine torque by which the line pressure is controlled.

For example, claim 1 recites an ECU programmed to "input a first torque signal obtained by estimating an engine torque in accordance with vehicle operating conditions and the target shift ratio; input a second torque signal obtained by detecting the engine torque; synthesize the first and second torque signals to provide an estimated-torque signal; and control the line pressure in accordance with the estimated-torque signal." Claim 4 requires a similar feature. Tokoro does not teach or suggest this feature.

In particular, Tokoro merely shows a belt-type continuously variable transmission 4 that includes an input disc unit (pulley 6,7), an output disc unit (pulley 8, 9), and a belt 11 placed around the input and output disc units. A control unit 100 is employed to control the operation of the transmission 4. The control unit 100 is configured to: (1) calculate, for each given time, an amplitude ratio between a vibration component of the torque of the input disc unit that corresponds to the engine explosion interval and that of the torque of the output disc unit that corresponds to the engine explosion frequency; and (2) reduce the line pressure when a rate of the present amplitude ratio relative to a preceding amplitude ratio is greater than a predetermined value or increase the line pressure when the rate is smaller than the predetermined value. (Figs. 4-5 of Tokoro.)

More specifically, the amplitude of the torque of the input disc unit that corresponds to the engine explosion frequency is represented by "A_{in};" the amplitude of the torque of the output disc unit that corresponds to the engine exposition frequency is represented by "A_{out};" and the amplitude ratio is presented by "A_{out}/A_{in}." In the case of "line pressure $P_L > P_{L1}$," the amplitude ratio "A_{out}/A_{in}" is kept at a generally given value near one even when the line pressure "P_L" is slightly reduced (column 5, lines 14-29 of Tokoro) because the rotations of the input disc unit and the output disc unit are completely synchronized. While, in the case of "$P_L < P_{L1}$," slipping occurs between the belt and the input and output disc units as the line pressure "P_L" is lowered, and thereby suddenly lowering the amplitude ratio "A_{out}/A_{in}."

(Column 5, lines 14-29 of Tokoro.) In the case of "line pressure $P_L = P_{L2}$," the belt shows a complete slippage against the output disc unit. (Column 5, lines 14-29 of Tokoro.)

In Tokoro, by processing the output signals of the torque sensors 29 and 30, the value "Aout/Ain" (the ratio of the amplitude of the torque on the output shaft and the amplitude of the torque on the input shaft) is detected. Then, control is made such that the line pressure P_L is adjusted to a value approximately equal to "P_{LI}" in accordance with "A_{out}/A_{in}" (which lowers with the reduction of the line pressure). (Column 5, lines 30-43 of Tokoro.) More specifically, by increasing or decreasing the line pressure, the increase or decrease of the value "A_{out}/A_{in}" is detected, and the line pressure is controlled to a value that is taken just before the time when the value "A_{out}/A_{in}" becomes smaller than a predetermined value. That is, the slippage of the belt is detected by checking a time lag between the input torque and the output torque.

In an alternative embodiment, the phase difference between the torques on the output shaft and the input shaft is monitored to control the amount of hydraulic pressure supplied to the CVT 4 instead of the ratio of the amplitude of the torque on the output shaft and the amplitude of the torque on the input shaft. (column 9, lines 30-48 of Tokoro.)

In contrast, the technique of the present invention comprises the actual engine torque and the estimated engine torque being combined to produce an estimated torque signal. The PTO asserts, however, in the "Response to Arguments" section that:

> Tokoro does indeed disclose first and second torque signals (from sensors 29 and 30) that are clearly connected to the ECU program in Figure 1. Both the sensors detect or estimate engine torque both directly and indirectly. Sensor 29 directly measures the engine torque along the shaft (2) of the engine and sensor (30) indirectly measures the engine torque along the output shaft (30)(sic) of the system. These two signals are sent to the ECU to program... (Paragraph 7 of the Office Action.)

It is respectfully submitted that Tokoro does not teach what the PTO asserts. The sensor 29 detects the torque of the input shaft and sensor 30 detects the torque of the output shaft. Signals from these sensors are used to determine either the ratio of the amplitude of the torque on the output shaft and the amplitude of the torque on the input shaft or the phase difference between the torques on the output and input shafts. Even if the sensor 29 directly measures the engine torque along the shaft 2 or the sensor 30 indirectly measures the engine torque along the output shaft 10, there is no disclosure or suggestion that an estimated engine torque is determined and used to obtain a first torque signal, which is synthesized with a

second torque signal obtained by the detected engine torque. The assertion by the PTO that "[b]oth sensors...estimate engine torque both directly and indirectly" is not supported by the teachings of Tokoro because Tokoro teaches no such estimation but the reference merely teaches the use of the sensors 29 and 30 to directly measure the torques of the input and output shafts, respectively. Thus, the signal from the torque sensor 29 (or the signal from the torque sensor 30) is not an estimated engine torque signal but merely an actual shaft torque signal.

In view of the above reasons, Tokoro does not teach or suggest the claimed first torque signal of claims 1 and 4, and thus claims 1 and 4 are allowable over Tokoro.

Claim 7 is drawn to a method requiring the steps of "inputting a first torque signal obtained by estimating an engine torque in accordance with vehicle operating conditions and the target shift ratio; inputting a second torque signal obtained by detecting the engine torque; synthesizing the first and second torque signals to provide an estimated-torque signal; and controlling the line pressure in accordance with the estimated-torque signal." As discussed above, Tokoro does not teach or suggest the claimed first torque signal required by claim 7. Thus, claim 7 is allowable over Tokoro.

Claims 2, 5, and 8 depend from claim 1, 4, or 7 and are allowable therewith, for at least the reasons set forth above, without regard to the further patentable limitations contained therein.

For at least these reasons, favorable reconsideration is respectfully requested.

Rejection of Claims 3, 6, and 9 based on Tokoro and Hendriks

Claims 3, 6, and 9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tokoro in view of U.S. Patent 5,431,602 ("Hendriks"). Claims 3, 6, and 9 depend from one of independent claims 1, 4, and 7 and contain all the limitations of their respective independent claims. As presented above, Tokoro does not teach or suggest the claimed first torque signal as required by independent claims 1, 4, and 7. Hendriks does not cure this deficiency. Thus, claims 3, 6, and 9 are allowable for at least these reasons without regard to the further patentable limitations contained therein. Favorable reconsideration is respectfully requested.

Conclusion

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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